# Spécialité de Master « Optique, Matière, Plasmas »

*Stage de recherche (4 mois minimum, à partir de début mars 2010)*

**Proposition de stage pour l'année 2009-2010 (ne pas dépasser 1 page)**

*Date de la proposition :12/10/2009*


| **Responsable du stage** /*internship supervisor* | | | |
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| | | Organisme :CNRS | |
| Site Internet/*web site* : | http://neel.cnrs.fr/spip.php?rubrique47 | | |
| Adresse/ *address* : | 25, rue des martyrs, 38042 Grenoble | | |
| Lieu du stage/ *Internship place*: | Institut Néel, 25, rue des martyrs, 38042 Grenoble | | |


**Titre du stage** /*internship title* : Tunable single photon source based on decoherence


Résumé/*summary*

Experiments previously restricted to the field of atomic physics with isolated two-level atoms and high-Q cavities can nowadays be implemented using solid-state emitters and optical microcavities, paving the road towards integrable information processing. The strong confinement of electron and holes in semiconductor quantum dots (QDs) results in a discretization of their electronic energy levels and to an attractive set of atom-like properties, such as spectrally narrow emission lines at low temperature, and the ability to generate quantum states of light. QDs provide efficient solid-state single photon sources, making them similar to artificial atoms. At the same time, impressive progresses in the technology of solid-state cavities allow to observe cavity quantum electrodynamics effects for a single QD embedded in a solid-state optical microcavity, like Purcell effect [1] and vacuum Rabi splitting [2].

Still, the two-level model to describe a QD reaches its limits. A QD interacts with phonons and carriers of the solid-state matrix it is embedded in indeed, which provides an additional source of decoherence with respect to isolated atoms. Recent theoretical results [3,4] show that the influence of the environment can be exploited to achieve tunable single photon sources and indistinguishable photon sources, which are precious ressources for quantum information. Moreover, the interaction with the environment depends on experimentally tunable parameters like temperature and pump power, which allows to explore new and unexpected regimes for cavity QED. The PhD will be devoted to the study of the spontaneous emission of a QD with respect to these tunable parameters. The candidate will be involved in the development of samples aimed at getting the deterministic coupling of a single quantum dot to a cavity mode, and will develop the optical experiments to implement an efficient and tunable single photon source based on decoherence and cavity funneling.



[1] J. M.Gérard et al, Phys. Rev. Lett. 81, 1110 (1998), M. Munsch et al, Phys. Rev. B 80, 115312 (2009).
[2] K. Hennessy et al, Nature 445, 05586 (2007).
[3] A. Auffèves, B. Besga, J.M. Gérard and J.P. Poizat, Phys. Rev. A 77, 063833 (2008).
[4] A. Auffèves, J.M. Gérard and J.P. Poizat, Phys. Rev. A 79, 053838 (2009).


**Toutes les rubriques ci-dessous doivent obligatoirement être remplies**

**Ce stage pourra-t-il se prolonger en thèse ?** *Possibility of a PhD* **? : Oui**

**Si oui, financement de thèse envisagé/** *financial support for the PhD* **:**

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|---|---|---|---|
| Lasers et Matière | x | Physique des Plasmas | |
| Optique de la science à la technologie | x | Lumière, Matière : Mesures Extrêmes | x |

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